ABSTRACT

A heat transfer loop system includes a primary passive two-phase flow segment in which the working fluid vaporizes in the evaporator, is driven by the vapor pressure towards the condenser via the vapor transport line, condenses in the condenser, and is further driven towards the liquid reservoir; and a secondary actively pumped liquid flow segment in which the liquid in the reservoir is drawn by a liquid pump into the evaporator, where a portion of the liquid is vaporized by the heat input and moves into the primary segment while the excess liquid is pumped back to the reservoir. The evaporator consists of a porous wick and one or more liquid arteries encased in the porous wick. The liquid arteries have porous walls to allow liquid phase working fluid to flow across the wall into the surrounding porous wick. The liquid supply into the evaporator moves through the liquid arteries while being drawn into the porous wick by capillary action. The remaining (or excess) liquid continues to move through the arteries and eventually out of the evaporator and into the reservoir. The liquid and vapor flows in the primary passive two-phase flow segment are driven by the pressure gradient caused by the temperature difference between the evaporator, condenser and reservoir. The porous wick provides sufficient capillary force to separate the liquid inside the arteries and the vapor in the evaporator.